AWM
ASSOCIATION FOR WOMEN IN MATHEMATICS

Volume 30, Number 4 NEWSLETTER July–August 2000

PRESIDENT'S REPORT

AWM has a new employee — or rather, our part-time employee Roya Jaseb is moving into the full-time position of Program and Grant Administrator. Welcome Roya! Doug Farquhar is shifting from full-time to half-time as Finance Administrator while he begins his own business.

Think now about applying for the AWM Workshop at the January Joint Math Meetings, with an application deadline of September 1. Meantime, I hope to see many AWM members at the MAA Mathfest and the AMS Mathematical Challenges meeting, both to be held in UCLA at the beginning of August. AWM will have a significant presence at both meetings. At the former, Audrey Terras will give the AWM-MAA lecture, "Finite Quantum Chaos." At the latter, Carolyn Mahoney will give a special presentation on "Demographic trends and challenges for mathematics" followed by a discussion. There will be an AWM reception at both meetings. And I'm sure AWM President-Elect Suzanne Lenhart is looking forward to seeing you at the SIAM Annual Meeting in July, where she is once again co-organizing an AWM Workshop with a focus on research and career advice, and at the IMA/AWM Workshop "Connecting Women in Mathematical Sciences to Industry" in September.

Also, here's a reminder to check and update your entry in the *Combined Membership List* (CML). You can get there via the AWM website (www.awm-math.org) or directly (www.ams.org/cml). By now, all AWM members should be listed, with their AWM membership noted; also, you can add a link to your web page. As a member said:

> The more women that we can encourage to create webpages with links to their research and their curriculum vitas, the better. It will make it a lot easier for conference organizers to find speakers. I've been searching ... [for] women for a special session I'm organizing, and it's much easier to check a webpage for research than ... MathSciNet. Besides ... MathSciNet is way behind schedule and has zilch for most recent Ph.D.'s.

IN THIS ISSUE

AWM
ASSOCIATION
FOR WOMEN IN
MATHEMATICS

The Association was founded in 1971 at the Joint Meetings in Atlantic City. The purpose of the association is to encourage women to study and to have active careers in the mathematical sciences. Equal opportunity and the equal treatment of women in the mathematical sciences are promoted.

The *Newsletter* is published bi-monthly.
The Editor welcomes articles, letters, and announcements.

Circulation: 4,000.

One of the things that comes with being AWM President — or perhaps just with being a prominent woman in mathematics — is the range of demands and opportunities for communicating directly with the public. Here is a sampling from a one-week period, May 12–19.

(1) I visited with over a hundred students at Columbia High School in Maplewood, New Jersey. First I talked about my career, my research on soap bubbles and crystals, and being a woman in mathematics, and then I answered questions on all those topics for about half an hour.

In general, I get a variety of email messages from students requesting various information from me, often as part of a class project on women mathematicians (or sometimes living mathematicians, male or female). Just since February, I have had messages from two students at the high school above plus: Natick, MA, 8th grade; Omaha, NE, high school; Iowa, 6th grade; Rutgers staff daughter; Connecticut College, sophomore; California State University, student; Florida, 11-year-old; Bartonville, IL, high school; Australia, university student; San Francisco, CA, high school. (One message was somehow lost; a teacher left a phone message asking me please to respond to the message from her student!)

Messages that elicited positive responses from me included: "I found information about you through the Women in Mathematics web site. I picked you because you sounded interesting and partly because you went to college in Massachusetts. I have looked at your home page.... In reading about your work, I found some information on soap bubbles." Another was "We have to do a bio-poem on our mathematician and I was wondering if you could help me with some questions about you.... Thank you very much for helping me with this but I understand if you are too busy to reply." Not so effective an approach: "Please send me this information ASAP."

But back to Columbia High School: their teacher Mr. Roberto Reyes had assigned students to do research on women mathematicians, and two had chosen me. One of them, Hua Zhang, was particularly persistent and engaging, and since Maplewood is within an hour of where I live, I finally made the time to visit. The students even videotaped the whole event, so perhaps they'd make it available if other schools wanted a copy.

(2) I received the following email from the AWM office: "Jean: A reporter from the *Times Dispatch* in Richmond, VA wants to talk to someone regarding the % of women involved in mathematics, battling stereotypes. She is doing a story on a local teacher in Richmond-area and wants a national perspective." So I talked to the reporter. For someone who just wants to see the statistics, we can refer them to the article "AWM in the 1990s" posted on the AWM website.

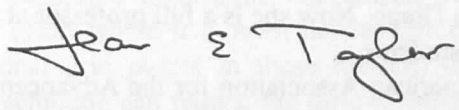
(3) I began preparing to serve on the panel of an Alumni Forum at Princeton University Reunions entitled "The Underrepresentation of Women in Science and Engineering: Why Too Few?" In particular, I

began reading the book *Why So Slow?* by Virginia Valian (MIT Press, 1998), which I highly recommend.

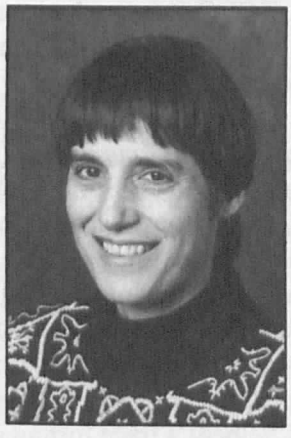
(4) I continued to prepare for the June 5–9 meeting at the United Nations colloquially known as "Beijing+5," since it is five years after the Fourth United Nations Conference on Women (which I also attended, as a representative of AAAS).

One of the frustrations posed by all these opportunities is the desire to do even more. Wouldn't it be nice to mail copies of the AWM *Newsletter* to each student correspondent? I think I need something like a secretary for the AWM president....

And this was a relatively low-key week for me! There were, of course, other things, such as AWM Executive Committee business, preparation for a talk on the work of a recent grad student of mine, and preparation for initiating web-based homework for the 3000-student calculus course at Rutgers. Finally, there were personal sources of joy in my "significant other" getting an honorary doctorate and my daughter finishing her undergraduate work. It was also the week where even Rudy Giuliani discovered that politics isn't everything, a good reminder of how important that personal stuff is.



Jean Taylor
Princeton, NJ
May 20, 2000



MEMBERSHIP AND NEWSLETTER INFORMATION

Membership dues

Individual: $50 Family (no newsletter): $30
Contributing: $100 Retired, part-time: $25
Student, unemployed, developing nations: $15
Friend: $1000 Benefactor: $2500
All foreign memberships: $8 additional for postage
Dues in excess of $15 and all contributions are deductible from federal taxable income.
Institutional Members:
Level 1 (one free basic job ad and up to ten student memberships): $150 ($230 foreign)
additional student memberships: $15 ($23 foreign) for next 15; $11 ($19 foreign) for remainder
Level 2 (one free basic job ad and up to three student memberships): $95 ($120 foreign)
Affiliate Members: $250
Institutional Sponsors:
Friend: $1000+ Patron: $2500+
Benefactor: $5000+ Program Sponsor: $10,000+

Subscriptions and back orders

All members except family members receive a subscription to the newsletter as a privilege of membership. Libraries, women's studies centers, non-mathematics departments, etc., may purchase a subscription for $50/year ($58 foreign). Back orders are $6/issue plus shipping/handling ($5 minimum).

Payment

Payment is by check (drawn on a check with a U.S. branch), U.S. money order, or international postal order. Cash payment will be accepted if necessary, but only in U.S. currency.

Ad information

AWM will accept advertisements for the *Newsletter* for positions available, programs in any of the mathematical sciences, professional activities and opportunities of interest to the AWM membership and other appropriate subjects. The Director of Marketing, in consultation with the President and the Newsletter Editor when necessary, will determine whether a proposed ad is acceptable under these guidelines. *All institutions and programs advertising in the newsletter must be Affirmative Action/Equal Opportunity designated.* A basic ad is four lines of type. Institutional members receive one free basic job ad as a privilege of membership. For non-members, the rate is $60 for a basic ad. Additional lines are $6 each.

Deadlines

Editorial: 24th of January, March, May, July, September, November
Ad: 1st of February, April, June, August, October, December

Addresses

Send all **Newsletter** material **except ads and material for book review and education columns** to Anne Leggett, Math Department, Loyola University, 6525 N. Sheridan Road, Chicago, IL 60626; email: leggett@math.luc.edu; phone: 773-508-3554; fax: 773-508-2123. Send all **book review** material to Marge Murray, Math Department, 460 McBryde Hall, Virginia Tech, Blacksburg, VA 24061-0123; email: murray@calvin.math.vt.edu and all **education column** material to Ginger Warfield, Math Department, University of Washington, Seattle, WA 98195; email: warfield@math.washington.edu. Send everything else, **including ads and address changes**, to Dawn V. Wheeler, 4114 Computer & Space Sciences Building, University of Maryland, College Park, MD 20742-2461; phone: 301-405-7892; email: awm@math.umd.edu.

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AWM DEADLINES

NSF-AWM Travel Grant: October 1, 2000; February 1 and May 1, 2001

AWM Workshop, New Orleans: September 1, 2000

Louise Hay Award: October 1, 2000

Alice T. Schafer Prize: October 1, 2000

Noether Lecturer Nominations: October 15, 2000

AWM CALENDAR

AWM Workshop, SIAM meetings, Puerto Rico, July 9–11, 2000

AWM-MAA Lecture, Mathfest, August 3–5, 2000

AWM special presentation, AMS Mathematical Challenges of the 21st Century, August 7–12, 2000

IMA/AWM Workshop, September 8–10, 2000

See pages 28–30 for more information.

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AUDREY TERRAS AT MATHFEST

Audrey Terras of the University of California, San Diego will deliver the AWM-MAA Invited Address "Finite Quantum Chaos" on August 4, 2000 at 8:30 A.M. at the Mathfest to be held at the University of California, Los Angeles (August 3–5, 2000).

Abstract

Physicists have long studied spectra of Schrödinger operators and random matrices, thanks to the implications for quantum mechanics. Analogously number theorists and geometers have investigated the statistics of spectra of Laplacians on Riemannian manifolds associated with arithmetic groups. Sarnak calls this "arithmetic quantum chaos." Equivalently one studies the zeros of Selberg zeta functions. Parallels with the statistics of the zeros of the Riemann zeta function have been evident for some time. Here we survey what may be called "finite quantum chaos" — seeking connections with the continuous theory. The results can also be formulated in terms of Ihara zeta functions of graphs.

Biographical Information

Audrey Terras received her B.S. degree in mathematics from the University of Maryland, College Park in 1964 where she was inspired by the lectures of Sigekatu Kuroda to become a number theorist. She was particularly impressed by the use of analysis (in particular using zeta functions) to derive algebraic results (e.g. about the structure of the ring of integers in an algebraic number field). She received her M.A. (1966) and Ph.D. (1970) from Yale University.

In 1972 she became an assistant professor of mathematics at the University of California, San Diego. Now she is a full professor at UCSD where she has had 20 Ph.D. students.

She is a fellow of the American Association for the Advancement of Science and has served on that organization's mathematics section nominating committee. She has served on the Council of the American Mathematical Society and various AMS committees and was an editor of the *Transactions of the AMS*. Currently she is an associate editor of book reviews for the *Bulletin of the AMS* and the chair of the Western Section Program Committee. She has served on various AWM committees in the past.

She has written three books: *Harmonic Analysis on Symmetric Spaces and Applications*, Volumes I and II, Springer-Verlag, New York, 1985, 1988 and *Fourier Analysis on Finite Groups and Applications*, Cambridge University Press, Cambridge, 1999. She also co-edited, with Dennis Hejhal and Peter Sarnak, the proceedings from a 1984 conference on Selberg's trace formula. Her research interests include number theory; harmonic analysis on symmetric spaces and finite groups along with its applications; special functions; algebraic graph theory, especially zeta functions of graphs; and Selberg's trace formula.

Current research involves finite analogues of the symmetric spaces of her Springer-Verlag volumes. This led her to work on spectra of graphs and hypergraphs attached to finite matrix groups, also coverings of graphs and their zeta and L-functions. These functions are analogues of the Riemann and Selberg zeta functions.

AWARDS AND HONORS

CONGRATULATIONS to the women listed below for their meritorious achievements!

Professor MARSHA BERGER, New York University, has been elected to the National Academy of Sciences.

Professor Berger is on the faculty of NYU's computer science department. In addition, she is associate director of NYU's Courant Institute of Mathematical Sciences. She received her Ph.D. in computer science in 1982 from Stanford University. Professor Berger's research is in large-scale scientific computing, with applications in the area of computational fluid dynamics. One area involves the currently time-consuming task of grid generation, needed, for example, to compute the flow around a full aircraft in three dimensions. She also develops adaptive algorithms for use in these applications. Adaptive algorithms concentrate the computational effort where it is most needed (by concentrating additional grid points in these regions, for example). This technique can reduce the turnaround time for flow simulations from months to days or hours.

Professor Berger said, "This is truly an unexpected honor. I am pleased to see the interdisciplinary work needed for large-scale scientific computing being recognized in this way. The Courant Institute is a great home for this kind of research." NYU President L. Jay Oliva said, "Marsha Berger is a brilliant scientist. Her work is as elegant as it is innovative, and it has led to concrete improvements in aircraft design. Her intellect and commitment to inquiry are qualities that we cherish here at NYU." Professor David McLaughlin, director of the Courant Institute, said, "Professor Marsha Berger is a leader in the new generation of computational scientists who develop methods of larger scale simulation for application throughout science, technology, engineering and society. We at the Courant Institute are very pleased that the National Academy of Science recognizes her many research accomplishments in this new and important field of computer science."

NANCY KOPELL, professor of mathematics and co-director of the Center for BioDynamics (CBD), has been named Boston University's first William Goodwin Aurelio Professor of Mathematics and Science.

"We are honored to have her occupy this new professorship in the College of Arts and Sciences," says Dennis Berkey, University Provost and Dean of the College of Arts and Sciences.

Kopell co-founded CBD in 1997 with James Collins, professor of biomedical engineering, launching a multidisciplinary effort that combines advanced mathematics, biology, and engineering to gain a better understanding of physiological systems in humans and other species and to develop new medical devices and treatments.

Kopell has been a member of the faculty of Boston University's College of Arts and Sciences since 1986. She was a Fellow of the John D. and Catherine T. MacArthur Foundation from 1990–1995 and was elected to the National Academy of Sciences in 1996.

Nancy Kopell Photo credit: Boston University

"Nancy is one of the leading biomathematicians in the world," says Collins. "She began working on problems in mathematical biology long before it was fashionable, and based on her work mathematical biology has developed into a fertile and well recognized area of research. Importantly, Nancy is not only a research superstar; she is also a first-rate mentor for young people. She spends an enormous amount of time and energy in training the next generation of biomathematicians."

CBD colleague John White, assistant professor of biomedical engineering, points out that her work "is a wonderful example of how close collaboration between experimentalists and theorists can lead to quantum leaps in our understanding of difficult problems."

"This opportunity will allow me to broaden my efforts in interdisciplinary training throughout the University," says Kopell. "It will give me the opportunity to be much more involved in collaborative activities among the faculty and students."

The chair is named for William Goodwin Aurelio, who graduated from Boston University in 1900. He went on to become professor of Greek language and literature and also taught courses in Bible appreciation, retiring from the university in 1940. He bequeathed his entire estate of $125,000 to the college when he died in 1951. By the late 1970s the endowment had grown to allow two chairs to be established, and has now grown sufficiently to add a third Aurelio chair.

Several women in mathematics and computer science received Sloan Fellowships. Grants of $40,000 for a two-year period are administered by each Fellow's institution. Once chosen, Fellows are free to pursue whatever lines of inquiry are of most interest to them, and they are permitted to employ fellowship funds in a wide variety of ways to further their research aims.

NINA AMENTA is a faculty member in computer science at the University of Texas, Austin. She received her Ph.D. from UC Berkeley. She works with the Algorithms and Computational Theory group and the Computer Graphics lab. Recently she has been studying algorithms for connecting unordered points into piecewise-linear curves (in the plane) or surfaces (in 3D).

ELENY-NICOLETA IONEL, a professor in the Department of Mathematics at the University of Wisconsin, received her Ph.D. from Michigan State University. Her eresearch interests are symplectic geometry, in particular Gromov-Witten invariants and enumerative invariants,

NSF-AWM TRAVEL GRANTS FOR WOMEN

The objective of the NSF-AWM Travel Grants program is to enable women to attend research conferences in their fields, thereby providing a valuable opportunity to advance their research activities and their visibility in the research community. By having more women attend such meetings, we also increase the size of the pool from which speakers at subsequent meetings may be drawn and thus address the persistent problem of the absence of women speakers at some research conferences.

Travel Grants. These grants provide full or partial support for travel and subsistence for a meeting or conference in the applicant's field of specialization. A maximum of $1000 for domestic travel and of $2000 for foreign travel will be applied. For foreign travel, U.S. air carriers must be used (exceptions only per federal grants regulations; prior AWM approval required).

Eligibility. These travel funds are provided by the Division of Mathematical Sciences of NSF, and the research conference must be in an area supported by DMS. For example, this includes certain areas of statistics, but excludes most areas of mathematics education and history of mathematics. Applicants must be women holding a doctorate (or equivalent experience) and having a work address in the U.S. (or home address, in the case of unemployed mathematicians). Anyone who has been awarded an AWM-NSF travel grant in the past two years or who has other sources of external funding, including *any* NSF grant, is ineligible. Partial support from the applicant's institution or from a non-governmental agency does not, however, make the applicant ineligible.

Target dates. There are three award periods per year. An applicant should send *five* copies of 1) a description of her current research and of how the proposed travel would benefit her research program, 2) her curriculum vitae, 3) a budget for the proposed travel, and 4) information about all other sources of travel funding available to the applicant along with *five* copies of her cover letter to: Travel Grant Selection Committee, Association for Women in Mathematics, 4114 Computer & Space Sciences Building, University of Maryland, College Park, MD 20742-2461. If you have questions, contact AWM by phone (301-405-7892) or email (awm@math.umd.edu). Applications via email or fax will not be accepted. The next deadlines for receipt of applications are **October 1, 2000** and **February 1** and **May 1, 2001**.

gauge theory and Sieberg-Witten invariants.

LYDIA KAVRAKI is a computer scientist at Rice University who received her Ph.D. from Stanford University. Her research lies in the area of Physical Computing. She investigates algorithms and system architectures for solving complex geometric problems arising in the physical world and applications in a number of areas including robotics (motion planning, manufacturing, assembly sequencing), medicine (computer assisted surgery), computational biology, and computational chemistry (pharmaceutical drug design).

GIGLIOLA STAFFILANI, an assistant professor in mathematics at Stanford University, received her Ph.D. from the University of Chicago in Mathematics. She works on the global regularity of solutions of nonlinear wave equations.

The MAA's Board of Governors has selected GEORGIA BENKART, of the University of Wisconsin, Madison, as the newest George Pólya Lecturer. She will serve for the academic years 2000–01 and 2001–02. Her research is in the area of associative and nonassociative rings and algebras.

On a rotating basis, the MAA sections can invite any of the current Pólya lecturers to speak at a regional meeting. The award includes a stipend and covers the travel expenses involved in attending the section meetings.

LYNNE PARKER of the Computer Science and Mathematics Division of Oak Ridge National Laboratory is one of the five recipients of the fourth annual Presidential Early Career Awards for Scientists and Engineers. This award was presented on April 12, 2000 at the White House. Parker, a group leader in computational intelligence, was recognized for her research in cooperative robotics "as a shining example to future generations of researchers — the best of the group of scientists and engineers who will be responsible for America's 21st century greatness." Note that Parker is one of the invited speakers at the IMA Career Workshop (September 8–10, 2000) on "Connecting Women in Mathematical Sciences in Industry," which is co-sponsored by AWM.

The Tensor Foundation, working through the MAA, has awarded grants since 1995 for programs designed to encourage college, university, and high school participants to study mathematics. Grantees for 2000–01 include seven new projects and five renewals (we recognize the men who received these grants along with the women): NÜKET ACAR, The Penn State University; PAUL CHACON, JAMES DERR, and HORTENSIA SOTO-JOHNSON, University of Southern Colorado; CORINE FITZPATRICK and KATHRYN WELD, Manhattan College; ANGELA C. HARE, Messiah College; JOYCE HILLIARD-CLARK, North Carolina State University; ANN KAJANDER, Lakehead University, Canada; AMY MIKO and PETER SKONER, Saint Francis College; BONNIE L. OPPENHEIMER, Mississippi University for Women; KAREN SCHOTTER, Stevens Institute of Technology; MAZEN SHAHIN, College Misericordia; ANN E. TRAHANOVSKY-ORLETSKY, Morris College; and LYNDA WIEST, University of Nevada, Reno.

See http://www.maa.org/projects/maaprograms.hmtl #tensor for information on the application process.

CALL FOR NOMINATIONS: LOUISE HAY AWARD

The Executive Committee of the Association for Women in Mathematics has established the Louise Hay Award for Contributions to Mathematics Education, to be awarded annually to a woman at the Joint Prize Session at the Joint Mathematics Meetings in January. The purpose of this award is to recognize outstanding achievements in any area of mathematics education, to be interpreted in the broadest possible sense.

The nomination documents should include: a one to three page letter of nomination highlighting the exceptional contributions of the candidate to be recognized, a curriculum vitae of the candidate not to exceed three pages, and three letters supporting the nomination. It is strongly recommended that the letters represent a range of constituents affected by the nominee's work. *Five* complete copies of nomination materials for this award should be sent to: The Hay Award Selection Committee, Association for Women in Mathematics, 4114 Computer & Space Sciences Building, University of Maryland, College Park, MD 20742-2461. Nominations must be received by **October 1, 2000.** For more information, phone (301) 405-7892 or email awm@math.umd.edu. Nominations via email or fax will not be accepted.

EDUCATION COLUMN

What's in a Game?
A thought by any other name would feel as neat.

Over the past decade, I have been increasingly intrigued by the uses of games in the classroom. They seem to me to have a notable potential for engaging students and enticing them into discovering new concepts or applying old ones — but also for giving an impression of mathematical activity which is purely illusory. My interest was first piqued when I ran into them in the French mathematics education research program of *Didactique.* An alternative name for *Didactique* is the Theory of Situations, and a lot of the situations used both for teaching and for experimentation are based around games. One that is particularly key and accessible is the Race to Twenty, a version of Nim in which two players take turns adding either one or two to an ongoing sum with the objective of being the one to make the sum twenty. This game and the meticulous use made of it became the centerpiece in my efforts to explain *Didactique* to various collections of American colleagues. What struck me most in their responses was the degree to which on our side of the Atlantic we value the spontaneity and energy a game can generate. This resulted in a low-key experiment over a number of years in which I used Nim in teaching my own class of future elementary school teachers. They learned a lot, and I learned far more, especially in the area of how great the distance is between the first sighting of the kind of strategy that Nim requires and the ability to use that strategy in other contexts — not to mention recognizing contexts in which it can be used.

This issue continued bumping around at the back of my mind until this year, when I took advantage of one of the perks of academia: I opted to expand my thinking process by declaring a seminar on the subject. It wasn't quite the intimate conversation I had envisioned, because the notion of a course on games caught the fancy of an even wider spread of students than I had expected, but the result was a lively exchange of ideas. The class contained people now teaching in schools from elementary through community college, undergraduates who plan to go into the teaching of elementary or secondary school, regular mathematics majors, a couple of engineers, and someone who tutors math as a hobby. It was also nicely mixed with respect to gender, which forced me to be instantly conscious of one of the hazards of using games, to wit, the statistically supported observations of the differences in how males and females respond to competition. It took a couple of weeks of adjustments to arrive at a comfortable functioning level, and to my shame and sorrow I did lose one teacher who said she felt overwhelmed and outclassed, but eventually a careful balance of randomized and de-randomized groupings and some tactics for funneling competitive urges into collaborative ones produced a highly positive learning environment.

Given the background of the situation it seemed reasonable to start with Nim, so we did that. Predictably enough, we became instantly engrossed in strategies, and recognizing when to reapply a strategy, and the impact on the game of apparently minor changes in the rules. Eventually we tore ourselves away and spent some time on a pair of dice games and their attendant probabilities. Then we moved into Pico-Fermi, which is a paper-and-pencil version of Mastermind in which one player tries to guess a sequence of letters chosen by the other, aided by clues in the form of a "Pico!" for each correct letter in a given round and a "Fermi!" for each letter which is not only correct but in the correct location in the sequence. What made this game fascinating in our context was a pair of attributes: it is enormously adjustable, and clearly offering it at too simple a level produces boredom and offering it at too complex a level leads to wild guessing, while offering it at the right level is conducive to all manner of interesting deductive reasoning.

With all of these under our belts we were finally set to delve into the questions on which the course was built: Do these belong in the classroom? If not, why not? If so, when? And how do we help students connect the games with the rest of their learning, especially their mathematical learning? Two class members provided me with the perfect ammunition by stating in their class follow-up reports: "Playing the [Pico-Fermi] game was a lot of fun, but I'm still not entirely convinced that there is much math to be learnt from the game" and "We ... could not relate it to math. What it reminded me of was one of the sections on the GRE. Which is a lot of problem solving and critical thinking, but not math." I couldn't possibly have invented a better pair of

by Column Editor Ginger Warfield, Department of Mathematics, University of Washington, Seattle, WA 98195;
warfield@math.washington.edu

statements for launching a discussion, so I put them on the overhead and asked "So what *is* math and how do you think these games relate to it?" An intense half hour later, some were still trying to articulate an opinion, others had begun to adjust theirs, and everyone had realized the range and the pertinence of the replies to that question. For homework they had then to think some more and write up those thoughts. Some, reasonably enough, were still bewildered, but others had extremely cogent comments to contribute:

> As students play the game they are developing a strategy that systematically brings them to the correct answer. This is exactly what I think we are teaching when we teach math.
>
> Whether or not the game is math is arguable, but it's not as important as whether or not the game would improve a child's ability to understand math better and be able to learn math concepts more quickly.
>
> Whether this kind of thinking is mathematical, I can only say, I *think* it is. I think it is because when I am getting somewhere in the game, it *feels like* the same kind of thinking that is involved in solving some other math problems.

As the quarter ended, I reflected on my choice to run a mathematics class about the choice to run a mathematics class using games. I was struck by some parallels: both offer easy access to student engagement and both offer exciting possibilities for using that engagement to deepen the students' understanding. This led to an obvious concern: the third notable characteristic of teaching with games is that they can be so entertaining that the learning in the lesson gets swept gently under the carpet. I had easy ammunition to shoot down that concern for this particular class, though, thanks to the presence of class members who could write reports like: "I spent two class periods playing the game and increasing the level of difficulty. When one of my students commented that his head hurt from thinking, I felt Pico-Fermi was a worthy activity for the mathematics classroom."

SLOAN RESEARCH FELLOWSHIPS

Nominations for candidates for Sloan Research Fellowships are due by **September 15, 2000**. Candidates must be members of the regular faculty at a college or university in the United States or Canada and must be at an early stage of their research careers. For information contact: Sloan Research Fellowships, Alfred P. Sloan Foundation, 630 Fifth Avenue – Suite 2550, New York, NY 10111; email: gassman@sloan.org; url: http://www.sloan.org.

CALL FOR NOMINATIONS: ALICE T. SCHAFER MATHEMATICS PRIZE

The Executive Committee of the Association for Women in Mathematics calls for nominations for the Alice T. Schafer Mathematics Prize to be awarded to an undergraduate woman for excellence in mathematics. All members of the mathematical community are invited to submit nominations for the Prize. The nominee may be at any level in her undergraduate career. She must either be a U.S. citizen or have a school address in the U.S. The eleventh annual Schafer Prize will be awarded at the Joint Prize Session at the Joint Mathematics Meetings in New Orleans, Louisiana, January 10–13, 2001.

The letter of nomination should include, but is not limited to, an evaluation of the nominee on the following criteria: quality of performance in mathematics courses and special programs, demonstration of real interest in mathematics, ability for independent work in mathematics, and performance in mathematical competitions at the local or national level, if any.

With letter of nomination, please include a copy of transcripts and indicate undergraduate level. Any additional supporting materials (e.g., reports from summer work using math, copies of talks given by members of student chapters, recommendation letters from professors, colleagues, etc.) should be enclosed with the nomination. Send *five* complete copies of nominations for this award to: The Alice T. Schafer Award Selection Committee, Association for Women in Mathematics, 4114 Computer & Space Sciences Building, University of Maryland, College Park, MD 20742-2461. Nominations must be received by **October 1, 2000**. If you have questions, phone 301-405-7892 or email awm@math.umd.edu. Nominations via email or fax will not be accepted.

AWM WORKSHOP FOR WOMEN GRADUATE STUDENTS AND RECENT PH.D.'S

supported by the Office of Naval Research, the National Science Foundation, and the Association for Women in Mathematics

Over the past twelve years, the Association for Women in Mathematics has held a series of workshops for women graduate students and recent Ph.D.'s in conjunction with major mathematics meetings.

WHEN: The next AWM Workshop to be held in conjunction with the annual Joint Mathematics Meetings will be in New Orleans, Louisiana, January 10–13, 2001 *(pending final funding approval)*. The Workshop will be held Saturday, January 13, 2001 with an introductory dinner and discussion group on Friday evening, January 12.

FORMAT: Twenty women will be selected in advance of the workshop to present their work; the selected graduate students will present posters and the recent Ph.D.'s will give 20-minute talks. AWM will offer funding for travel and two days subsistence for the selected participants. The workshop will also include a panel discussion on issues of career development, a luncheon and a dinner with a discussion period. Participants will have the opportunity to meet with other women mathematicians at all stages of their careers. All mathematicians (female and male) are invited to attend the program. Departments are urged to help graduate students and recent Ph.D.'s who do not receive funding to obtain some institutional support to attend the workshop presentations and the associated meetings.

MENTORS: We also seek volunteers to lead discussion groups and to act as mentors for workshop participants. If you are interested in volunteering, please contact the AWM office.

ELIGIBILITY: Applications are welcome from graduate students who have made substantial progress towards their theses and from women who have received their Ph.D.'s within approximately the last five years (whether or not they currently hold a postdoctoral or other academic position.) Women with grants or other sources of support are welcome to apply. All non-U.S. citizens must have a current U.S. address. All applications should include a curriculum vitae, a concise description of research (2–3 pages), and a title of the proposed talk/poster. All applications should also include at least one letter of recommendation; in particular, graduate students should include a letter of recommendation from their thesis advisors. Nominations by other mathematicians (along with the information described above) are also welcome. See our web site www.awm-math.org for some advice on the application process from some of the conference organizers.

Send **five** complete copies of the application materials (including the cover letter) to:

Workshop Selection Committee
Association for Women in Mathematics
4114 Computer & Space Sciences Building
University of Maryland
College Park, Maryland 20742-2461

Phone: 301-405-7892
Email: awm@math.umd.edu WWW: www.awm-math.org

APPLICATION DEADLINE: Applications must be received by **September 1, 2000**. Applications via email or fax will not be accepted.

HRUMC

The seventh annual Hudson River Undergraduate Mathematics Conference took place on April 8, 2000, at Vassar College in Poughkeepsie, NY. Over 400 people participated from over 50 colleges and universities, with 145 students and faculty presenting mathematics from familiar disciplines such as calculus and statistics as well as exotic ones like game theory and cryptology.

The day began at 8:30 A.M. with a delicious breakfast. After fueling up, participants attended a variety of student and faculty talks. This opening round of talks lasted an hour, and it whetted appetites for Professor Peter Hilton's invited address "The Chinese Remainder Theorem." His presentation engaged his mathematically hungry audience with both mathematical proofs and mathematical philosophies.

Hilton praised mathematics for its ability to prove, whereas the sciences can only refute possibilities. He emphasized that this distinction makes math truly special, and that the language of proofs is elegant and empowering. He demonstrated his philosophies by proving the Chinese Remainder Theorem. Hilton's speech was inspirational for the hundred of mathematicians in his audience.

A long lunch followed, during which students and faculty from different colleges and universities mingled. The afternoon consisted of two rounds of talks, all of which demonstrated the excitement about mathematics that Peter Hilton had spoken of.

Eric Katerman, Williams College Class of 2002

Overall, the impressions left on those who participated in the conference were that mathematics is enjoyable, accessible, and fun. Once again, the Hudson River Undergraduate Mathematics Conference succeeded in its goal to give students a chance to show off their joy for and abilities in mathematics.

Special thanks for organizing the conference go to the steering committee, which is composed of Andrew Coppola, Benjamin Lotto, John McCleary, Rahul Magavi, and Sarah Radke from Vassar College; Brenda Johnson from Union College; Emelie Kenney from Siena College; Jerry Reiter from Williams College; and David Vella from Skidmore College. Additionally, the conference participants thank Vassar College for being excellent hosts. Lastly, we thank the Sallie Mae Corporation for providing generous financial support that made this wonderful event possible.

AAUW: TECH-SAVVY

As violent electronic games and dull programming classes turn off more and more girls, the way information technology is used and taught in the nation's classrooms must change, according to *Tech-Savvy: Educating Girls in the New Computer Age,* published by the American Association of University Women Educational Foundation. In contemporary culture, the computer is no longer an isolated machine: It is a centerpiece of science, the arts, media, industry, commerce, and civic life.

CALL FOR NOMINATIONS: THE 2001 NOETHER LECTURE

The Association for Women in Mathematics established the Emmy Noether Lectures to honor women who have made fundamental and sustained contributions to the mathematical sciences. This one-hour expository lecture is presented at the Joint Mathematics Meetings each January. Emmy Noether was one of the great mathematicians of her time, someone who worked and struggled for what she loved and believed in. Her life and work remain a tremendous inspiration.

The mathematicians who have given the Noether lectures in the past are: Jessie MacWilliams, Olga Taussky Todd, Julia Robinson, Cathleen Morawetz, Mary Ellen Rudin, Jane Cronin Scanlon, Yvonne Choquet-Bruhat, Joan Birman, Karen Uhlenbeck, Mary Wheeler, Bhama Srinivasan, Alexandra Bellow, Nancy Kopell, Linda Keen, Lesley Sibner, Ol'ga Ladyzhenskaya, Judith Sally, Olga Oleinik, Linda Rothschild, Dusa McDuff, Krystyna Kuperberg, and Margaret Wright.

The letter of nomination should include a one page outline of the nominee's contribution to mathematics, giving four of her most important papers and other relevant information. *Five* copies of nominations should be sent by **October 15, 2000** to: The Noether Lecture Committee, Association for Women in Mathematics, 4114 Computer & Space Sciences Building, University of Maryland, College Park, MD 20742-2461; phone: 301-405-7892; email: awm@math.umd.edu

Tech-Savvy is the culmination of two years of work by the AAUW Educational Foundation Commission on Technology, Gender, and Teacher Education. The report combines the insights of its 14 commissioners at the forefront of cyberculture and education, findings from the Foundation's online survey of 900 teachers, qualitative focus group research with more than 70 girls, and reviews of existing research.

The question is no longer whether computers will be in the classroom, but how computers can be used to enhance teaching and learning — ideally, in ways that promote the full involvement by girls and other groups currently underrepresented in many computer-related endeavors. The commission's themes and recommendations, while focused on girls in schools, would, if addressed, improve the quality of the computer culture for all students. For more information, see http://www.aauw.org/2000/techsavvy.html.

AWM CONFLICT OF INTEREST POLICY

A conflict of interest may exist when the interest (financial or other) or concerns of any member of AWM, or the member's immediate family, or any group or organization to which the member has an allegiance or duty, may be seen as competing or conflicting with the interests or concerns of AWM.

When any such potential conflict of interest is relevant to a matter requiring participation by the member in any action by AWM or any of its committees to which the member belongs, the interested party shall call it to the attention of AWM or the committee and such person shall not vote on the matter. Moreover, the person having a conflict shall retire from the room in which the organization or its committee is meeting (or from a conference call) and shall not participate in the final deliberation or decision regarding the matter under consideration.

The foregoing requirements shall not be construed as preventing the member from briefly stating her position in the matter, nor from answering pertinent questions of other members, as her knowledge may be of great assistance.

The minutes of the meeting of the organization or committee shall reflect when the conflict of interest was disclosed and when the interested person did not vote. When there is a doubt as to whether a conflict of interest exists, and/or whether a member should refrain from voting, the matter shall be resolved by a vote of the organization (or its committee), excluding the person concerning whose situation the doubt has arisen.

A copy of this conflict of interest statement passed by the AWM Executive Committee, Vancouver, 8/16/93, shall be published once a year in the AWM *Newsletter*, and any member serving as an officer or on a committee shall be advised of the policy upon undertaking her duties.

"WOMEN IN MATH" CLASS

Many students never learn about the mathematical achievements of women and minorities even though incorporating these achievements into classes has been shown to be beneficial to all students (including white males). In addition, "women in math" courses are often taught without significant mathematical content, focusing instead on history and equity issues.

Last fall, I taught a "women in math" class that combined significant mathematical content with history and equity issues. Students were assigned several papers on women mathematicians of their choice. Students chose an aspect of the mathematics to focus on and research, which they then wrote about in their own words and presented to the rest of the class.

The class, consisting of seven students, of whom two were men, went very well. Students worked hard and learned about many different areas of mathematical research, in addition to history and equity issues. When asked to comment on the course's goal of having students develop the ability to focus on a reasonable aspect of mathematics to research carefully, write up and speak on, one student remarked that this was "kind of hard sometimes, but very good." Another student commented that she felt that this class helped her in advancing her ability to do research and speak about math, and that it was very encouraging. A third student, who plans to be a

by Sarah J. Greenwald, Appalachian State University

high school teacher, commented that this was one of the few classes in the department that he could walk away from and actually say, "I will use this in my classroom."

Detailed daily class work and other information has been placed on the web at www.mathsci.appstate.edu/~sjg/womeninmath in the hope that this will help teachers incorporate women's mathematical achievements into their classrooms.

A MATHEMATICS MANIFESTO

Quantitative Awareness as Another Thinking Cap

Quantitative literacy in the population at large could make a powerful contribution towards improving both the inner and outer environments we face in our lives. The dissemination and teaching of quantitative awareness and literacy to children and to adults of all ages has become a matter of increasing importance and interest. This awareness can be elicited in many ways to reveal previously hidden or ignored aspects of our environment.

Professor Lynn Steen at a recent meeting of the AMS displayed the following list of goals of quantitative literacy: algebra for all: intermediate or college algebra; civic literacy: informed skepticism about uses of data; computer mathematics: proficiency in standard tools; cultural literacy: nature and history of mathematics; functional mathematics: skills for life and work; instrumental mathematics: predicting and planning; language of science: math for scientists and engineers; mathematical modeling: solving real-world problems; parental literacy: skills and dispositions for parents; problem solving: seeing mathematics in ordinary events; quantitative practice: habitual patterns of action; quantitative reasoning: logical thinking; and statistical thinking: exploring data, drawing inferences.

This broad reach of mathematics has been discussed at previous meetings of the AMS and elsewhere. Some examples follow.

In "A guide to blazing a math trail," Mary-Margaret Shoaf describes strolling with small children through a playground and observing the math all around. Thus the speed of descent on a slide translates into its steepness, the steepness into the slope and the slope into observing the relation between its length and height. The children's conceptual vocabulary is enriched by the word "slope."

"Information, data and decisions" by Deborah Hughes Hallett describes how statistical tools were taught to and applied by a group of government bureaucrats from a variety of developing countries. One student sharply scrutinized the use of weighted averages of various indices such as GNP, life expectation and literacy in a measure of development, the so-called HDI or Human Development Index. Statistics reveal that this index is highly sensitive to the weighting and ordering of the components. A relatively small change in these weights produces a massive change in the HDI and so in the way funds are allocated. Equally blatant was the use of positive correlation between the HDI and GNP by governmental agencies. This provoked a violent reaction in class due to the students' knowledge that the latter functioned as a component of the former to begin with. The students became strongly alerted to the danger of the manipulation of data for political ends. At the same time the importance of quantitative knowledge and tools to unearth false conclusions was made ever more evident.

In "A fourth grade experience," Donald Saari. mathematically demonstrates the unreasonableness of declaring the candidate with the largest total vote as the winner in an election with more than two candidates, where the sentiment of the electorate would be more accurately reflected by a preference voting scheme. Professor Saari explained the combinatorics to a group of fourth graders using the vote for class president as an example. The youngsters immediately concurred with his method of choosing, and maintained that the "winner take all" outcome would be unfair.

"Integrating mathematics and culture in a developing nation" is a project of Dean E. and Susan C. Arganbright. Students studied traditional patterns of design in weaving, leathercraft, etc. from a geometrical standpoint. This new look at these ancestral creations triggered their enthusiasm to learn about abstract concepts such as linear transformations, periodicities, and symmetry and stimulated them to use these to invent new designs.

Professor Persi Diaconis applies what he labels the "Birthday Tool," i.e. the well-known likelihood of a coincidence of birthdays in a relatively small group of people, to the occurrence of events in our lives that we apprehend as coincidences. He thereby clears away some

Miriam Lipshutz Yevick, Emerita, Rutgers University

of the confusion or obfuscation frequently created by such appearances, providing a more rational approach to world events.

"Does the evidence of authority prevail over the authority of evidence?" is the report of Shandy Hauk and Mark K. Davis. It took nearly fifteen hundred years for the eventual overthrow by Copernicus, Kepler, Galileo and Newton of the official but erroneous cosmology of Aristotle and Ptolemy, much of this delay caused by fear of authority. These teachers acquainted their math students with some of the weaknesses in the work of authority figures such as Pythagoras, with the intent of freeing them from their fear of mathematics. This encouraged the students not to be overawed by established truth and to trust in their own ability to think independently.

"A course in quantitative literacy," developed by Miriam L. Yevick in lieu of the standard remedial one, was taught at Rutgers University to students with poor mathematics backgrounds. Basic quantitative skills were extracted from applications relevant to the students' life environment: for example, using powers of ten to estimate the total intake by the Port Authority during rush hour and comparing the total net accumulated revenues to the original cost of construction; developing a "feel" of magnitudes by fitting items such as the number of hours worked in a lifetime, the number of pounds of meat consumed in one year in developed as against developing countries, the number of millionaires in the world, etc., into power-of-ten slots.

An adaptation of this course was taught to a group of seniors at a retirement community. They were encouraged to transmit this way of viewing the world to their grandchildren as a token of their own concern and as a bridge to the future. The students', both old and young, fear of mathematics was greatly reduced after they recognized the relevance of applying quantitative thinking to their lives. They were also alerted to the potential of using a math problem as therapy when engaged in tedious work or overwhelmed by the stress of personal problems, or by insomnia or when suffering from physical pain.

Quantitative awareness has among its many positive consequences: 1) an appreciation of a new dimension in experiencing the world, 2) the development of a sense of abstraction, generalization and precision of thought leading to an ability to think in larger units and so to recognize patterns of personal and social problems in a global context, 3) enhanced confidence through the mastery of new tools to evaluate the "established truth" with a more critical stance, and 4) conquered fear of math, spilling over into a lowering of fear in general and a potential to refashion one's habits of mind. It opens up the possibility of basic changes in one's "cosmology" on a personal and communal level.

A Call to Action

It has been said that "one can stretch a word to cover the world." Surely mathematics is such a word. We have a lot to sell.

My suggestion is that we create a Math Propaganda Consortium and that we take to the road – both literally and virtually – to spread the "Mathematics Word" (perhaps in the manner of the Fabians who disseminated their simply written tracts on social problems on street corners, in public forums, etc.). The Mathematics Forum (http://forum.swarthmore.edu) for example has a website where it is possible both to teach and solicit comments and contributions of a kind similar to the types of examples above, i.e. quantitative approaches to such things as budgets, national and local priorities, election expenditures, and environmental problems as well as to personal life experiences and observations. Students and academics and other volunteers participate in these exchanges, thus creating a bond between the mathematically curious and the "experts." A web ad supported by the Propaganda Consortium might attract an increasing number of participants to this site.

A clear and humane vision is sorely lacking in most of the world's governing bodies in the face of the numerous difficult global problems. All kinds of things have gone out of kilter even in the most advanced countries: health care, education, legal and political arrangements, environmental balance, distribution of wealth, let alone the allocation and exploitation of resources. Many of us, as teachers, know the spark of understanding lighting up in the eyes of our students when they grasp a concept and realize its use and that they themselves can apply it. It is becoming more necessary than ever that the citizenry at large be enabled to search for and advance solutions from below and "figure" things out at the local and global level. This requires a critical stance to what one is told "from above," be it by the media or politicians, coupled with a confidence in one's own ability to think clearly, freely and rationally. Let's go for it!

SONIA KOVALEVSKY HIGH SCHOOL MATHEMATICS DAYS

The Sonia Kovalevsky High School Mathematics Days below were funded by a grant awarded to AWM by Coppin State University, Microsoft Corporation, and the National Security Agency. Hearty thanks to all the funding agencies!

Mississippi University for Women

Mississippi University for Women (MUW) hosted its third Sonia Kovalevsky High School Mathematics Day on April 8, 2000. It was attended by thirty-seven high school girls and four teachers. Of the thirty-seven students, eighteen were African-American and one was Asian-American. We sent letters to all of the area high schools inviting students to participate, and we sent an announcement over the statewide fax line to all public schools. We also advertised in the area newspapers, at the annual conference of the Mississippi Council of Teachers of Mathematics, and at the local Mu Alpha Theta mathematics tournament. We draw many of our participants from a distance. This year three different groups traveled over 150 miles to attend.

The program began at 9:00 A.M. The participants registered and received a packet of materials which contained a schedule of the day's activities, AWM's *Careers That Count*, and information about MUW. Dr. Jane Wenstrom welcomed the group and gave a brief biography of Sonia Kovalevsky.

The morning program consisted of two workshops that both teachers and students attended. The first workshop was run by Ms. Kathy McGarvey of the Mississippi School for Mathematics and Science. She explained the number systems used by the ancient Chinese and Mayan cultures and had the students do their own calculations with these number systems. Ms. McGarvey also explained how to use a slide rule and provided materials for the students to create their own.

The second workshop was divided into two parts. Dr. Lesia Crumpton-Young, associate dean of the college of engineering at Mississippi State University (MSU), spoke to the group about engineering and what preparation was necessary to study engineering. Dr. Crumpton-Young was accompanied by two MSU engineering undergraduates who divided the participants into groups. Each group was assigned a different model to construct using Lego Dacta sets. At the end of this workshop, each group did a brief presentation describing the construction of their model and how it worked.

After a buffet lunch in the President's Dining Room, the teachers and students separated for the first afternoon workshop. Dr. Bonnie Oppenheimer of MUW led the teacher's workshop on Texas Instruments' Calculator-Based Ranger (CBR). The teachers used the CBR to collect motion data and worked through some sample classroom activities.

The first afternoon workshop for the students was led by Dr. Dorothy Kerzel of MUW. She discussed a variety of ways in which the value of π may be approximated. Students did their own approximations using geometry, Archimedes' method of inscribed and circumscribed polygons, Buffon's needle problem, and geometric probability.

The final workshop of the day was led by Dr. Beate Zimmer and Dr. Tim Causgrove, both of MUW. They began the workshop by discussing minimal paths in two dimensions and generalized the idea to minimal surfaces in three dimensions, using a natural medium for inspecting minimal surfaces — soap bubbles. They constructed a number of three-dimensional frames for the students to use in their initial investigations and then allowed students to construct their own shapes.

Local CBS and NBC affiliates sent cameras to capture some of the activity, and both ran stories on that night's local news broadcast. Overall, the day was a definite success. The participants really enjoyed themselves and appreciated all of the hands-on activities. Thank you AWM for the support to host our third Sonia Kovalevsky High School Mathematics Day!

University of St. Thomas

A symposium for young women to discover career opportunities in mathematics was held at the University of St. Thomas, St. Paul, MN on Saturday, November 20, 1999. It was organized by Dr. Cheri Shakiban, chair of the Department of Mathematics. More than 100 high school girls and their teachers attended.

The symposium began with a welcome from the chair of the department and the Dean, Dr. Tom Connery. A short presentation on the lives and work of Sonia

Jane Hurley Wenstrom, Ph.D., Mississippi University for Women, Division of Science and Mathematics

Looking at soap bubbles, Mississippi University for Women SKHS Day

Kovalevsky and Emmy Noether was given by junior math major Janine Bergsted. Senior math major Angie Priley talked about contemporary women working in mathematics: Ingrid Daubechies, Karen Uhlenbeck, and Mary Wheeler. Following this introduction, there was a presentation "Overview of careers in mathematics" by Dr. Brenda Kroschel. After a short break, a panel discussion with four local women holding successful positions in mathematics related jobs was held; the panelists were: mathematics research, Dr. Joan Hutchinson, Professor, Macalester College; actuarial science, Susan Witcraft, FCAS, Principal, Milliman and Robertson; engineering, Angela Gilchrist, SMT Engineering Manager, Cyber Optics Corp.; and neuroscience, Dr. Martha Flanders, Associate Professor of Neuroscience, University of Minnesota. The panel was moderated by Theresa Strie, a 1993 math graduate of UST who is currently a Ph.D. candidate in mathematics at the University of Nebraska. The panelists illustrated how mathematics is used in their daily work, and they advised the high school students to take as many math courses as possible. They also spoke about some career options that are available to women who pursue mathematics related degrees in college. The audience was given the opportunity to ask questions during the panel; the participants found the panel discussion very lively and useful. It was certainly the highlight of the symposium. In addition the panel members indicated how much they enjoying being part of the day and asked to be invited back.

Following the morning session, lunch was provided for all the preregistered participants. Afterward, there were four 40-minute hands-on workshops. The workshops are designed to get the students involved with the process of learning, helping them to experience the connections among different mathematical applications. Dynamical Systems and Fractal Geometry was conducted by Dr. Cheri Shakiban. In this workshop participants had hands-on experience with understanding and developing chaotic systems, snowflakes, and fractals. In the Topology workshop conducted by Dr. Melissa Shepard, through the actual physical construction of polyhedra, participants conjectured and proved Euler's formula for the sphere. The Euler characteristic of other surfaces (e.g., torus, n-holed torus, projective plane and Klein bottle) were also explored. In Queuing Theory, led by Theresa Strie, the participants played an enjoyable queue game which measures the waiting time during word searches. Students identified factors which affect the waiting time, discovered the natural connection between the game and a telecommunications system, and determined how to improve the performance (waiting time) of a telecommunications system. Dr. Heekyng Youn led the Statistics and Actuarial Science workshop, where participants experimented to see how sampling is used to derive information from a large data set. They also used statistics to price insurance products.

At the closing of the Day, each participant was presented with AWM's *Careers that Count*, a T-shirt, a pencil, and a mathematical game.

PROPORTIONS OF WOMEN FACULTY AND STUDENTS IN THE MATHEMATICAL SCIENCES: A TREND ANALYSIS BY INSTITUTIONAL GROUP

This paper summarizes our analysis of data from the annual survey of mathematical science departments by the American Mathematical Society (AMS). First, we examine how gender proportions of faculty and undergraduate majors in the mathematical sciences vary across institutional groups. These groups are defined by the AMS according to type of degree offered, highest degree offered, and selectivity. Second, we investigate how these proportions have changed over time using AMS data from the past decade. Finally, we explore the relationship between the proportion of women faculty and women majors across institutional types as a test of the role model hypothesis, which posits that women faculty members have a positive effect on the attraction and retention of women mathematics students.

INTRODUCTION

Many mathematicians are aware that the mathematics department at the University of Wisconsin recently celebrated the centennial of granting its first mathematics Ph.D. What most people may not know is that two of the first four mathematics Ph.D.'s and three of the first 10 mathematics faculty (1849–1891) at that university were women. The first two women Ph.D.'s, Charlotte Pengra and Florence Allen, remained at Wisconsin as faculty members and, between 1901 and 1907, were the only women among a total of 19 faculty with various lengths of service (University of Wisconsin, 1997). Allen stayed on the mathematics faculty for a total of 45 years (until 1946) and during her tenure, six additional women earned a doctorate in mathematics — although Allen was not formally listed as a dissertation advisor for any doctoral students (University of Wisconsin, 1997).

This example illustrates that women mathematicians have been around for a long time — albeit somewhat invisible and marginalized, as mathematics has traditionally been a prototype for the image of a male-dominated profession. There is even a lingering controversy about whether females, on average, have less innate mathematical ability than males do (for the pro side of this controversy, see Benbow & Stanley, 1980; and Hoben, 1985; for critical views, see Eccles & Jacobs, 1986; and Entwisle & Hayduk, 1988). During the last decades, women have made considerable progress in entering and pursuing mathematics as a field of study, but they have not made as many strides in achieving successful mathematics careers. Full gender parity in mathematics remains elusive, and progress towards it lags somewhat behind women's advances in other sciences. The gender issue in mathematics is, therefore, still very much alive.

While prior studies have established a detailed quantitative picture of the proportion of women obtaining doctorates in the mathematical sciences (Billard, 1991; Jackson, 1991; Radke Sharp, 1995; Radke Sharpe & Fuller, 1995), few studies have examined the trends in the proportion of women mathematics majors, and fewer still have examined the relationship between the proportion of women students and women faculty. Our study contributes relevant quantitative information in these areas. Our analysis focuses exclusively on the mathematical sciences (mathematics, operations research, applied mathematics, and statistics) and quantifies trends in women's participation within this field over the past decade.

First, we investigate how the gender proportions of faculty and undergraduate majors vary across different institutional types. Are the women in mathematics distributed evenly across institutional types, or is there a gender segregation within mathematics? Second, we examine the relationship between the proportions of women faculty and women majors in mathematical sciences across institutional types as a test of the role model hypothesis. In public debates, and in academic

By Norean Radke Sharpe, Associate Professor of Statistics, Babson College, Babson Park, MA and Gerhard Sonnert, Research Associate in Physics, Harvard University. *Reprinted from* Journal of Women and Minorities in Science and Engineering, Volume 5, *pp. 17-27, by permission of the authors and the publisher.* *Authors' note: An earlier version of this paper was presented at the* Women & Other Faces in Science Conference *at the University of Saskatchewan, Saskatoon, Canada, September 26–29, 1996. For assistance in preparing the current version, the authors would like to thank their research assistant, Rebekah Silva.*

discussions of the factors that determine women's pursuit of careers in mathematics, this hypothesis has played a major role. It posits that women faculty members have a positive effect on the attraction and retention of women mathematics students. While we cannot answer this supposition, given the limitations of our data, we reveal an interesting pattern across institutions.

Prior Research

The rising numbers of women in many white-collar professions have often led to microdifferentations — to a horizontal gender segregation into different subspecialties and a vertical segregation along professional hierarchies (Evetts, 1996; Tang & Smith, 1996). Such segregation patterns have also been commonly observed in academe in general and in academic science (Blackburn & Lawrence, 1995; Rosenfeld, 1984; Sonnert, 1995a). We will examine whether these patterns hold true for mathematics.

Compared with the abundance of general talk about role models, prior quantitative work examining the relationship between women faculty and women science students is relatively sparse. However, pioneering work on the baccalaureate origins of doctorate-level scientists by M. Elizabeth Tidball (1986) confirmed the role model hypothesis. In her sample of 128 institutions, she found a significant positive correlation between the number of women faculty and the number of women baccalaureates who pursued a doctorate in science. She concluded that "the more adult women of accomplishment present in the environment, the more likely are women students to proceed to their own post-college accomplishments" (Tidball, 1986, p. 616). However, her sample was restricted based on doctorate output, her analysis was based on numbers — not on proportions, and she used institution-wide faculty data (as opposed to department-specific data). In contrast, our study uses proportions of both women majors and women departmental faculty to focus on the most relevant faculty role models — those in the student's own discipline.

Using data that are aggregated across the sciences is increasingly problematic for the study of gender issues. While there has been a substantial influx of women into the sciences over the past few decades, this influx has clearly been uneven (Vetter, 1981; 1987). According to reports published by the National Research Council (Hill, 1992; Ries & Thurgood, 1993), women have achieved a notable presence in the social and life sciences, but mathematics and the physical sciences still attract relatively few women. Furthermore, recent research by Radke Sharpe and Fuller (1995) and Frazier-Kouassi et al. (1992) has shown that scientific disciplines significantly differ from each other in the production of female doctorates. These differences suggest a shift from studies of women "in the sciences" to studies of women in individual science disciplines. Our study is able to examine the mathematical sciences specifically — both from the student perspective and from the faculty perspective.

An initial analysis of mathematics doctorate data was undertaken by Ruskai (1994), in which she compared the number of doctoral degrees earned by women to women faculty hired by departmental type. Her work demonstrated that, although women were earning between 20% and 25% (across all institutional groups) of the Ph.D.'s in the mathematical sciences from 1991 to 1993, the proportion of new doctoral hires over the same time frame ranged from a low of 7% for one departmental type to a high of 34% for another type. Our study expands upon Ruskai's work by conducting a more extensive analysis of the database of the American Mathematical Society (AMS); we examine the data from 1988 (when the genders were initially separated in the database) through 1995 — thus examining historic trends by gender and departmental type more completely.

Of course, career paths are highly complex and determined by many influences. In the literature, the role model hypothesis is not the only explanation of women's career outcomes (Lentz, 1980; Oates & Williamson, 1978; Verral, 1994), and recent research has warned that senior women scientists cannot automatically be considered role models and mentors for female students (Etzkowitz et al. 1994). In addition, sociological research has shown that institutional types with certain characteristics are associated with greater college degree attainment among women in general (Pascarella & Terenzini, 1991). Moreover, it is clear from prior research that women face obstacles during many stages of the science pipeline — not only during college. Graduate school, for instance, was found to include a wide array of gender-specific obstacles, ranging from insufficient financial support (Haven & Horch, 1972; Hornig, 1987; Widnall, 1988), and a lack of research assistantships (Billard,

1991; Widnall, 1988), to advisor-related issues (Berg & Ferber, 1983; Dresselhaus, 1986; Frazier-Kouassi et al., 1992; Hughes, 1994; Kjerulff & Blood, 1973). Furthermore, women scientists were found to encounter a variety of obstacles during the postdoctoral phase and their later career stages (Sonnert 1995a, 1995b; Sonnert & Holton, 1996). It is clear, therefore, that other factors besides same-gender role models are involved in ensuring opportunities for women in mathematics and science. More quantitative research is needed in this area.

Table 1. Description of Departmental Groups

Group I:	Composed of departments with doctoral program scores in the 3.5–5.0 range.
Group II:	Composed of departments with doctoral program scores in the 2.0–2.9 range.
Group III:	Contains the remaining U.S. departments reporting a doctoral program.
Group IV:	Contains U.S. departments (or programs) of statistics, biostatistics and biometrics reporting a doctoral program.
Group V:	Contains U.S. departments (or programs) in applied mathematics/applied science, operations research, and management science that report a doctoral program.
Group M:	Contains U.S. departments granting a master's degree as the highest graduate degree.
Group B:	Contains U.S. departments granting a baccalaureate degree only.

Note: Groups I and II include the leading departments of mathematics in the U.S. according to the 1982 Assessment of Research-Doctorate Programs conducted by the Conference Board of Associated Research Councils, in which departments were rated according to quality of their graduate faculty.

Source: 1994 Annual AMS-IMS-MAA Survey (Second Report)

METHODS

Data

This study uses data from 1998 to 1995, collected and maintained by the AMS from their annual survey sent to mathematical science departments in the United States. The departments are divided into seven groups (Groups I to V, Group M, and Group B) by the AMS according to the highest degree offered in the mathematical sciences discipline (see Table 1).[1] For confidentiality reasons, we could obtain and analyze the AMS data only after they were aggregated by these departmental groups. Incidentally, the time period covered in the study is the longest period available for statistical trend analysis, because the AMS survey changed its definition of departmental groups in 1996.

RESULTS

Means Across Departmental Types

Proportion of women majors. Table 2 contains the average proportions of women majors and faculty over eight years (1988 to 1995) for each departmental group (except Groups IV and V). We did not include these two institutional groups in our statistical analysis because there is more variability over these eight years within Groups IV and V, with respect to majors (standard deviations of 4.3% and 4.1%, respectively). This increased variability probably occurs because these groups included fewer institutions and fewer majors than the other groups, most likely because they comprise departments in subspecialties. The smaller sample size makes these groups more sensitive to individual fluctuations in reported numbers over the years.

According to the descriptive statistics in Table 2, the mean proportion of women majors across groups range from a low of 36.5% to a high of 44.6%. A one-way ANOVA[2] and Tukey-Pairwise comparisons ($\alpha = .05$) conducted on the mean percentages revealed some significant differences. The mean proportion of women majors in the top-ranked doctorate departments (Group I) is significantly lower than the proportion of women majors in all the other groups (Groups II, III, M and B). In addition, the mean proportion of women majors in the second-ranked doctorate departments (Group II) is significantly lower than the proportion of women majors in the remaining groups: the lowest-ranked doctoral departments (Group III), the master's departments (Group M), and the baccalaureate departments (Group B). These latter three groups all have similar proportions, which are not significantly different. *In summary, the percentages of women majors are significantly lower at the larger and more selective universities with mathematical science departments than at smaller universities, departments granting master's degrees only, and departments granting baccalaureate degrees only.*

Proportion of women faculty. For the purpose of consistency, we also excluded Groups IV and V from our analysis of women faculty data. Note that in Table 2, the variability over eight years *within* each group is

Table 2. Descriptive Statistics for Women Majors and Faculty (1988–1995)

	Percent Women Majors[a]				
Group	I	II	III	M	B
Years (N)	8	8	8	8	8
Mean	36.5%	40.3%	43.8%*	44.6%*	44.5%*
SD	(1.0)	(1.2)	(1.6)	(1.2)	(1.3)
	Percent Women Faculty[b]				
Group	I	II	III	M	B
Years (N)	8	8	8	8	8
Mean	6.4%	7.6%	9.1%	14.3%*	17.9%*
SD	(1.1)	(0.9)	(1.2)	(1.5)	(1.2)

[a] Percentage of women who are junior/senior mathematical science majors at the undergraduate level.

[b] Percentage of full-time women faculty who possess a doctorate.

* Mean is significantly greater ($\alpha = .05$) than the means for Groups I and II.

fairly consistent (standard deviation ranges from 0.9% to 1.5%) for the proportion of women faculty. However, the variability in the means *across* groups for women faculty is higher than it was for majors (faculty proportions range from 6.4% to 17.9%). As with the proportion of women majors, all statistical assumptions were verified before conducting the ANOVA. According to the Tukey-Pairwise comparisons ($\alpha = .05$), the mean proportion of women faculty for all of the departments with a doctorate program (Groups I to III) is significantly lower than the proportion of women faculty at those institutions with at most a master's program (Group M) or at most a baccalaureate program (Group B). In addition, the proportion of women faculty at baccalaureate institutions (Group B) is greater than the proportion at master's institutions (Group M). *In summary, the mathematical science departments at baccalaureate institutions have the greatest proportion of full-time women faculty, whereas the departments with doctoral programs have the lowest proportion.*

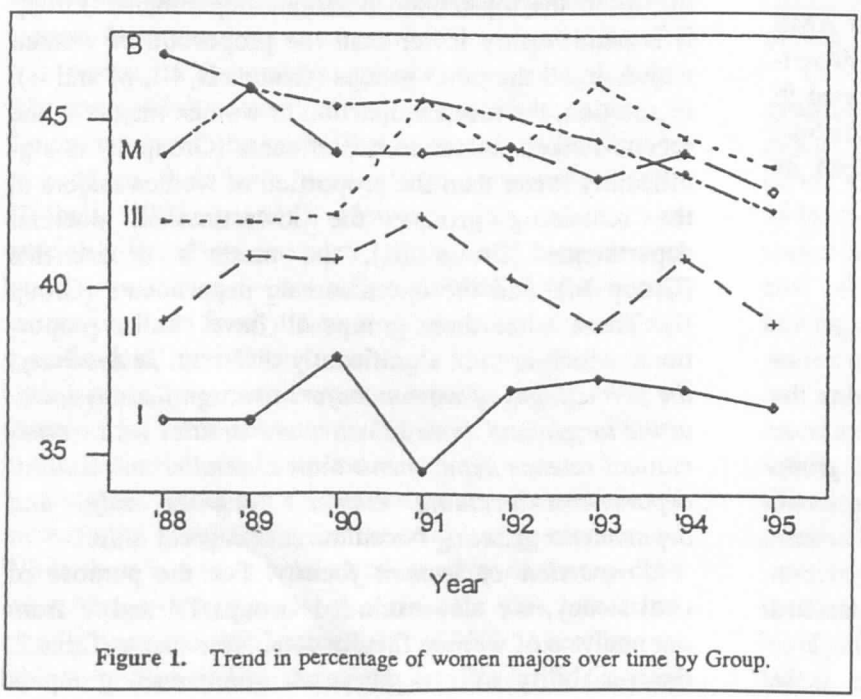

Figure 1. Trend in percentage of women majors over time by Group.

Trend Analysis of Group Percentages

Proportion of women majors. Examining the data over time confirms our earlier results of the high variability in the proportions of women majors within Groups IV and V. These two groups — the specialized departments with fewer majors — vary as much as 12%, with drastic peaks and valleys over the eight-year time frame. By contrast, the percentages of women mathematics majors in the other departmental types do not fluctuate as much, and instead appear to be either stationary or have a distinct trend. The trends in these departmental groups can be seen in Figure 1. It appears that the proportions for Groups I and II remain fairly constant,[3] while the proportions for Group III increase and those for Groups M and B slightly decrease over time. Also, Groups I and II have proportions that are consistently lower than those for the other three groups. These observations are consistent with the earlier analysis, which showed that these two groups have lower proportions of women majors than the other groups.

According to trend analysis, the change in the proportion of women majors in Groups III and M is barely significant,[4] while the percentages of women majors in Group B have decreased significantly at 0.5% per year.[5] For example, Group B reported an average high proportion of women majors in 1988 of approximately 47%, which declined to a reported average low of approximately 43.5% in 1995. If this trend continues, Group B will

have an average proportion of women mathematics majors of less than 40% by 2000. We should note, however, that these predictions can be unreliable because they are based on a limited number of years, and the actual numbers depend on a host of cultural, political and social factors.

Proportion of women faculty. Examining the percentages of full-time women faculty over time (see Figure 2), we see that all groups seem to be increasing at a steady rate. The groups are distinctly separated; Groups I, II and III consistently have proportions of women faculty that are significantly lower than those in Groups M and B. This separation of curves is consistent with the difference in the proportion of women faculty between groups, which was found earlier in our analysis of the means across groups. Not only do all the curves increase (at a rate that appears to be linear), but they also appear to be increasing at a *similar* rate for each group — unlike the trends in women majors.

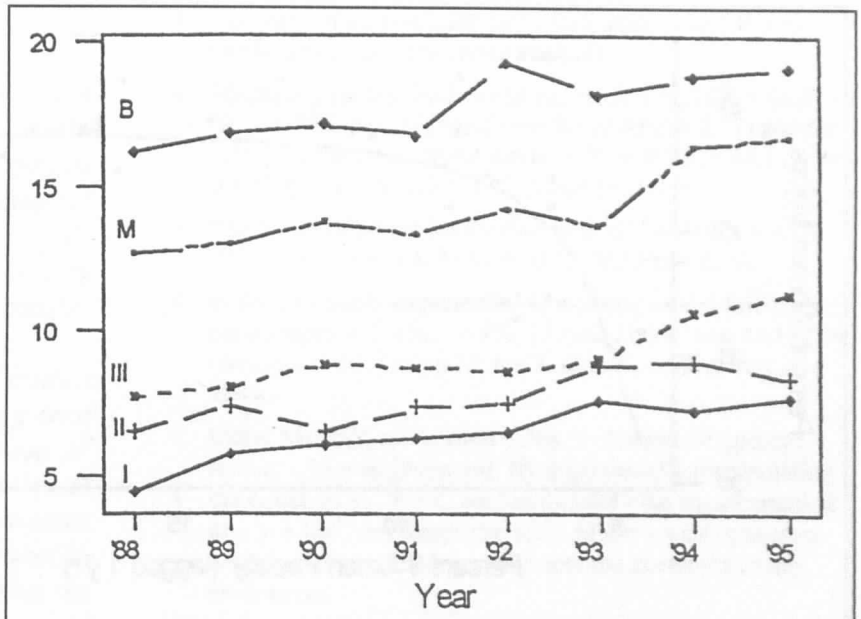

Figure 2. Trend in percentage of women faculty over time by Group.

According to trend analysis, all groups are increasing at an average rate of almost 0.5% per year. (Slopes range from 0.33 for Group III to 0.55 for Groups M.) Also, all groups are positively correlated with time and have high R^2 values when compared to those for the proportion of women majors (R^2 ranges from 0.72 for Group II to 0.91 for Group I). If these trends continue, the average proportion of full-time women faculty with Ph.D. degrees should increase to over 20% for baccalaureate mathematical science departments — and yet remain under 10% for Group I doctorate departments in 2000.[6]

DISCUSSION

As stated earlier, a key postulation of the role model hypothesis is that there is a positive relationship between the proportion of full-time women faculty and the proportion of women majors in mathematical science departments. Since students traditionally select their majors by the end of their sophomore year, and we are looking at junior/senior majors, we chose to lag our faculty variable by one year to reflect the proportion of women faculty the previous year. In addition, since we only have eight years of data for each departmental group, we chose to use data from all of the groups in this model — while still retaining their group identification. Our *a priori* hypothesis, then, is that we will find a significant positive correlation between percentage of women majors and percentage of women faculty (lagged one year).

We indeed found such a relationship, although it is clearly not linear. A quadratic model did appear to fit the data better (higher R^2); however, the peaking of the positive impact of women faculty proportions at about 14% seemed counterintuitive. A logarithmic function (using the natural log of the proportion of women faculty variable) continued to reveal a pattern in the residuals, indicating that another model may be better. The final model was determined from the Box-Cox Transformation,[7] which revealed a good and more intuitive fit. In this model, the positive impact of the proportion of women faculty levels off as the percentage approaches 15%, with no evident patterns in the residuals. A plot of this model is shown in Figure 3 ($R^2 = 0.51$). Note that according to the model, an increase in the percentage of women faculty from 5% to 10% is associated with a greater increase in the percentage of women majors (from about 33% to 43%) than an increase in the percentage of women faculty from 10% to 15%, or from 15% to 20%. In fact, these last two increases in faculty proportions are associated with little, if any, noticeable increases in student proportions.

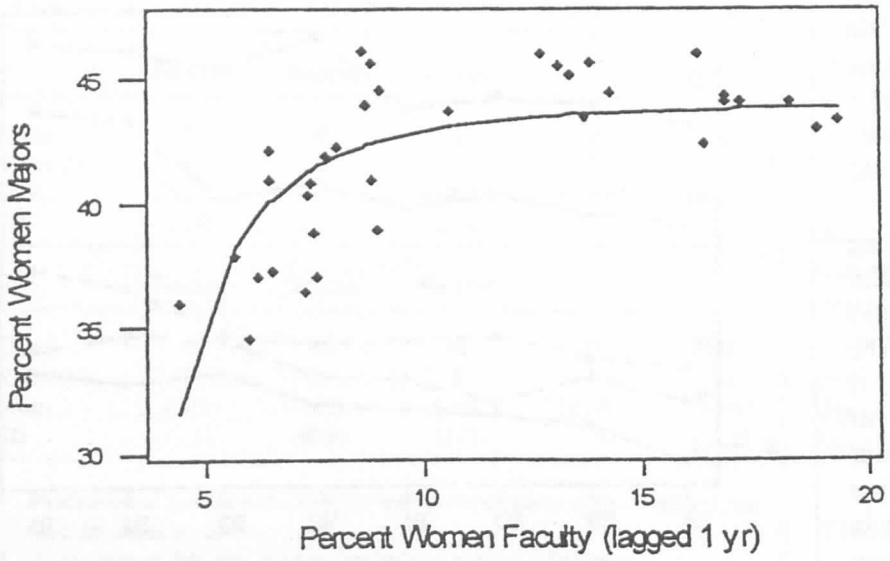

Figure 3. Relationship between percentage of women majors and percentage of women faculty (lagged 1 year) as obtained by a Box-Cox transformation ($y = 44.0–1063x^{(-3)}$) with the institutional groups aggregated.

It may be tempting to view this finding as an instance of a "critical mass" effect, which has sometimes been observed. Dresselhaus (1986), for instance, noted that isolated women in physics classes used to be very taciturn; but as soon as the proportion of women reached a critical mass of 10% to 15% of that class, women's level of participation became indistinguishable from men's. One might interpret our results along similar lines; once the proportions of women faculty — and thus the available role models — have reached a critical mass (10% to 15%), any further increase in the proportion of women faculty has little or no impact on the proportion of women majors. However, our aggregated data (across institutions) do not allow a firm conclusion about the relationship between the proportions of women faculty and women majors. Conditions and characteristics associated with *individual* departments can be expected to exert an influence on students' choices of majors.

While we have used the data from all the departmental groups to model the relationship between the proportion of women majors and women faculty, an identification of the data points in each group yields additional information. Figure 4 indicates that the groups are clearly separated from each other; the group with the lowest percentage of women faculty (Group I) also has the lowest percentage of women majors. Likewise, the two groups with the highest percentage of women faculty (Groups M and B) also have the highest percentage of women majors. *In summary, an increase in the proportion of women mathematics faculty appears to be related to an increase in the proportion of women mathematics majors across departmental groups.* However, we should note that because of the substantial collinearity of departmental group and proportion of women faculty, the departmental group itself, or factors associated with it, are potential confounding variables.

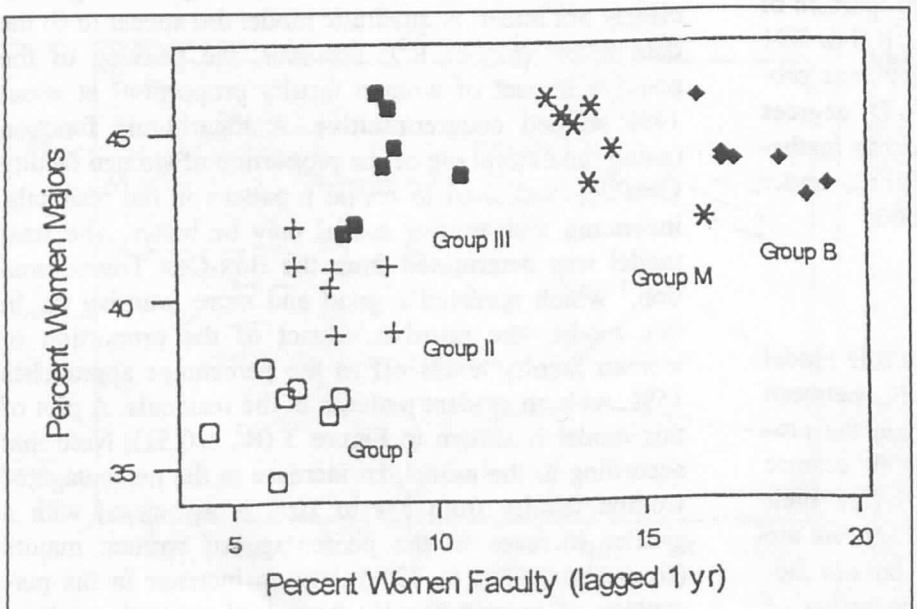

Figure 4. Scatterplot of percentage of women majors versus percentage of women faculty by institutional group.

We have shown that the larger and more selective universities report proportions of women majors that are consistently lower than those of their smaller

and less selective counterparts. We have demonstrated similar results with respect to the proportion of women faculty members; departments offering a master's or a baccalaureate as their highest degree employ significantly greater proportions of women than those departments offering doctorates. While the discipline of mathematics is no longer an overwhelmingly male domain, these results suggest a microdifferentation by gender within the discipline, with the women congregating in the less prestigious departmental groups.

Trend analysis revealed that the proportion of women mathematics majors has generally been stationary over our eight-year period; the exception is the group of baccalaureate math departments, which has experienced a slight decline in the overall percentage of women majors. On the other hand, the percentage of women faculty in all departmental types has increased over the past eight years at a similar linear rate of approximately 0.5% per year. Forecasts suggest that, if the current trend continues, the average proportion of women mathematics faculty could be over 20% at baccalaureate institutions by 2000.

Finally, our results indicate that, in general, the departmental groups with relatively low percentages of women mathematics majors also have relatively low percentages of women mathematics faculty. These results tend to corroborate the role model hypothesis to some extent; the proportion of women faculty is positively associated with the proportion of women majors. It is clear, however, that questions still remain and await further examination: Is this association due to confounding variables connected with departmental type? Is it influenced by department-level variables not considered? Finally, within what ranges is the association stronger or weaker? Only by looking at data that are disaggregated to the level of departments will we be able to answer these questions.

NOTES

1. The response rates for undergraduate data over the time frame of the study are generally over 75% for Groups I to III, over 65% for Group IV, and around 40% for Groups M and B. Response rates for Group V were more variable (from 23% to 57%). In general, response rates for faculty data are slightly higher for all groups (see AMS Surveys 1988 to 1995).
2. The assumption of homogeneity of variances was verified using the Bartlett Test.
3. This lack of a significant trend for Groups I and II was verified through time series analysis.
4. For Group III the linear trend model is $Y = 0.42t + 41.9$ ($R^2 = 0.386$, $p < .10$, MAD = 0.96, MAPE = 2.17) and for Group M the linear trend model is $Y = -0.32t + 46.1$ ($R^2 = 0.409$, $p < .10$, MAD = 0.77, MAPE = 1.74).
5. The linear trend model for Group B is $Y = -0.47t + 46.6$ ($R^2 = 0.740$, $p < .01$, MAD = 0.53, MAPE = 1.19).
6. In fact, a double-exponential smoothing model forecasts percentages of 9.4%, 10.4%, 13.6%, 21.1%, and 21.1% for Groups I to III, Group M, and Group B, respectively, for 2000.
7. Using Minitab, an optimal value for lambda of approximately -.33 was generated. By algebraically manipulating the equation $y^{(-1/3)} = x$, we can simplify the transformation into $y = 1/x^3$; this keeps the scale of the y-axis consistent with the other models and corrects the skewness of the error terms.

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AAAS REPORT

My plane arrived somewhat late, so I hurried to the opening ceremony where the keynote speaker, David Satcher, the U.S. Surgeon General, had already started. Since he had just begun, I had no trouble following his outline of the challenges that faced us in the new millennium. Included were our need to contain the smoking of our young people, their abuse of drugs, the obesity problem, their general lack of physical activity, and their engaging in violent behavior at a very young age.

The next morning, I went to a session on "Integrating Technology with Science Education" where Gary Marchionini of the University of North Carolina discussed his work. He spoke about the individual learning of the past that he said has now been superseded, as research has shown more success when students learn in groups. He thus favored group learning and cooperation as sole alternatives; I disagree with this.

excerpts from a report on the AAAS meeting, February 17–22, by Deborah Tepper Haimo, University of California, San Diego

I next attended the Education Section's Affiliates meeting. There, Mark Frankel gave us an update on the Court Appointed Experts Project designed to help judges needing scientific information. Federal judges have a right to appoint anyone they want to provide information on scientific matters. AAAS will provide names from which a presiding judge might select someone suitable, although the final decision still belongs to the court. AAAS needs names for its database. *I believe it is important for the mathematical community to make sure that mathematicians are included as is not the case now.*

A special topical lecture was given by Rita Colwell, former president of AAAS. She talked about interdisciplinary studies, noting that intercommunication among different agencies has increased and deepened over the years. Now, for example, AAAS and NSF are both looking into the future. Science and engineering are merging disciplines, in Colwell's view. Gone are the days when some complex area of study could develop alone. Indeed she stated that interdisciplinary education is best for students.

George A. Miller of Princeton University spoke on "Ambiguous Language." Our language is so complex that only the human brain can decipher the meaning of the words we use. Many words have multiple meanings, which prevents us from enabling computers to speak. Computers cannot deal with the multiple meanings. Surprisingly, perhaps, the common words are the worst!

The day's plenary lecture was given by Mamphela Ramphele, University of Cape Town. She stated that the United States is first in the world, a leader of science, whereas Africa is usually thought of as very poor. It has 18% of the world population, with limited ability to feed this growing population. It has the most cases of AIDS in the world. The focus today on globalization, with science of the utmost importance, has had a negative effect on the third world, where the information highway is largely barren. Africa is seriously affected by the lack of, or loss of, intellectual resources. The culture is more defensive than offensive, whereas scientific culture requires a willingness to challenge authority. It is thus important to raise Africa's educational level by providing good education, and democratic principles must be introduced. Unfortunately, the surrounding culture is not supportive of education, quite the contrary!

On Saturday morning, I attended the Education Business Meeting. There, the participants seemed particularly concerned about getting on the main program of the SIAM meeting. When speakers are chosen by the Education Section, the candidates may be well known by those in education and indeed may even be famous, but they usually are not known in the science disciplines as well as, say, biologists, chemists, or physicists. They are thus dismissed as unworthy of consideration as plenary or topical speakers.

During the noon hour, Senator Kit Bond of Missouri gave a topical lecture. He indicated that for most of the last 30 years, he had served in elective offices and so has no science background at all. He felt that as scientists we were aware that we have to attract the attention of the media. He urged us to find ways to do so if we want to get congressional support. He talked of a farmer who may today feed 129 people. That same farmer in the future will have to feed many more people at less cost and reduced acreage. He spoke of protestors who fought biotechnology; he claimed they must win early before people understand the benefits of biotechnology. He stressed the fact that we must help other countries to learn from us, without regulatory objectives. Poor and hungry people are targets of protestors who act like gods. Publishing papers, Bond said, is not enough. We must get out, listen, and become involved.

The first session I went to on Monday was "Reforming Science and Mathematics in Urban Schools: The Road to Success." Shirley Malcom in the opening presentation compared the learning process in mathematics to that of taking a subway and making sure that, despite some extra bus rides that individuals may take, everyone reaches a given destination. There was then a panel discussion on ensuring that all students are taught science and mathematics by teachers who are well prepared in both content and pedagogy, The first panelist, Joseph Krajeik, felt that technology and visualization, in particular, helped children learn. He was adamant that there must be a standards-based curriculum. He wanted middle school teachers to focus on standards and to engage in professional development. To this end, he suggested Saturday workshops and proposed that two or three teachers see an experienced person actually use technology. Gail Burrill asked in her presentation what she could do to make her students learn. She was wondering what it means to teach and asked in general how teachers might be enabled to get their students to learn. Concluding the session was Maria Santos who addressed the question of recruitment and wanted to know how one might entice the "best and the brightest." She proposed

putting pressure on administrators to increase salaries. She felt that recruitment must start early. She was sure that if teachers remained at their posts for five years, they would stay as there were all kinds of great rewards in teaching. Finally, she proposed working with universities to devise courses needed for teaching.

The special plenary lecture was given by the Honorable Madeline Albright. She stated that science and technology both give much to the country and are very much needed today. In the new budget, President Clinton is seeking a better situation for the sciences. She strongly supports international science, technology, and health-based issues, and wants the nation's foreign policy to concentrate on these.

On Tuesday morning, I attended the forum for school sciences where Vinette Jones of Howard University gave the plenary presentation. She noted that standards that should rank the U.S. as the top science place in the world are substantially lower than those in any other country. She thus asked what we know about this serious achievement gap to enable us to close it. She noted that our underachieving students are becoming increasingly difficult to deal with as the gap becomes institutionalized. The teaching policy in the U.S. leaves minority students out completely. They internalize the very low expectations teachers have of them, and they consequently stay in one section throughout their school years making no progress at all. There is danger in this approach, and it is wasteful as is apparent in U.S. education. A solid academic program is essential for all students. It is important to have teachers who care about their students and are excited about their subject, who have high expectations of all, and who reward and encourage academic excellence. Students should have positive role models with whom they can identify. In short, to be effective, teachers must focus on the subject areas, have experienced effective pedagogy, and deal with the equity issues. Further, they must work in a safe environment. It thus takes a whole village to educate children.

Jerry Valdez of the Fresno Unified School District was moved by Jones' early remarks. He told of growing up in Mexico where all the villagers came to his home so that his grandfather could read their letters to them. He was the only literate person in the village. As a result, Valdez's mother was determined that her children would at least be able to read. Of course, Valdez succeeded well beyond being able to read!

APPROPRIATIONS SUBCOMMITTEE BILL

Last week, the House VA-HUD-IA Appropriations Subcommittee passed on to the full committee its fiscal year 2001 bill, which allocates funds for organizations such as the National Science Foundation and NASA. In spite of strong support for the President's strong FY 2001 funding request, tight budget caps meant that the increases approved so far are modest.

While the Appropriations Subcommittee Bill is an important milestone in the budget process, it is possible that more funds will be introduced before the budget is finally passed sometime next fall. Therefore, it is important to maintain congressional interest in science funding between now and then.

The bill provides NSF $4.064 billion for FY 2001, an increase of $167.1 million, or 4.3 percent, over the FY 2000 appropriation. However, these numbers fall far short of the President's request in every category. For instance, Clinton's total request for NSF was $4,572m (+675.2m, +17.3%), with Human Resources getting a 4.9% boost overall ($32.41m) and Math and Physical Sciences getting a 16.3% increase ($123.6m).

The bill provides NASA $13.7136 billion, $112.8 million above FY 2000 and $322 million below the President's request of $14.035 billion. Within NASA, the Subcommittee provided the Office of Space Science $2.378 billion, $20 million less than the President's request, but an increase of $186 million over the FY 2000 level of $2.193 billion.

THE WASHINGTON POLYMATH: A Federal Policy Newsletter for Mathematicians, *Volume 2, Number 4, June 1, 2000; published by the JPBM.*

OPPORTUNITIES

EcFinMatStGradSchool

The purpose of this forum is to provide a gathering place for grad students (and aspiring grad students) in economics, finance, math, statistics and related disciplines. Students in these disciplines share some meaningful common experiences: a) brutal competition to get

into good programs, b) grueling first-year coursework and qualifying exams often meant to "weed-out" a significant proportion of the incoming class, c) skills, aptitudes and interests that can be easily turned to one's advantage in the private sector (hence, serious decisions about how to concentrate one's studies to keep all options open while maintaining an eye, perhaps, toward the academic job market), d) disciplinary cultures — especially at the graduate level — which are less than "warm and fuzzy," and profs/fellow students who may be lacking in some of the more important interpersonal skills, and e) research activities which are neither laboratory-based (as with the lab sciences and engineering) nor library-based (as with the softer social sciences and humanities).

Ideally, this will become a vibrant forum where students from a cross-section of related disciplines at many different universities might share their questions, concerns, frustrations and insights in a setting of relative anonymity and comfort. The main page is at http://www.onelist.com/group/EcFinMatStGradSchool; to subscribe to the list, visit http://www.onelist.com/subscribe/EcFinMatStGradSchool.

CAREER/PECASE Program Guidelines

CAREER/PECASE Program Guidelines are now available at http://www.nsf.gov/cgi-bin/getpub?nsf0089. The deadline date is **July 27, 2000**. Note that proposals must be submitted electronically via FastLane.

The Career program is intended to support excellent proposals from junior faculty who combine strong research activity with a genuine and substantive involvement in education. Proposals will be evaluated on the basis of *both* research and education. For the FY 2001 competition, the minimum award size is $250,000 in total. The award duration for all CAREER awards is five years.

NSF will select from the most meritorious awardees supported by the CAREER program the nominees for Presidential Early Career Awards for Scientists and Engineers (PECASE).

PECASE awards recognize outstanding scientists and engineers who, early in their careers, show exceptional potential for leadership at the frontiers of knowledge. This Presidential Award is the highest honor bestowed by the United States government on scientists and engineers beginning their independent careers. Beginning with the FY 2001 competition, the PECASE award will be an entirely honorary award that does not provide additional funds.

In the past years DMS has made a small number of Career awards. In the next year, owing to the high quality of the proposals that have been in the competition, the Division has decided to increase funds allocated for CAREER proposals.

The Division continues to encourage proposals to its "traditional" research grant programs that integrate research and education activity or that have significant education components.

IGERT

The program announcement for NSF's IGERT program is now available at http://www.nsf.gov/cgi-bin/getpub?nsf0078. The preproposal deadline is **July 19, 2000;** the full proposal deadline is January 26, 2001.

Initiated in 1997, the IGERT program was developed to meet the challenges of educating Ph.D. scientists and engineers with the multidisciplinary backgrounds and the technical, professional, and personal skills needed for the career demands of the future. The program is intended to catalyze a cultural change in graduate education, for students, faculty, and universities, by establishing new, innovative models for graduate education in a fertile environment for collaborative research that transcends traditional disciplinary boundaries. It is also intended to facilitate greater diversity in student participation and preparation and to contribute to the development of a diverse and globally aware science and engineering workforce.

Budapest Semesters in Mathematics Program

This program allows third and fourth year undergraduates to spend a semester or year studying mathematics in Budapest. Admission criteria are high, but the rewards are great. A semester immersed in the mathematical culture of Budapest is an intellectual adventure of the very first rank. A wealth of information, including pictures and an electronic application form, is available online at http://www.stolaf.edu/depts/math/budapest. Presently, the program can accommodate about 40 students per semester. The deadline for spring applications is **November 1, 2000**.

ADVERTISEMENTS

INSTITUTE FOR PHYSICAL SCIENCE AND TECHNOLOGY, COLLEGE OF COMPUTER, MATHEMATICAL AND PHYSICAL SCIENCES - UNIVERSITY OF MARYLAND, COLLEGE PARK - Director - The University of Maryland, College Park, invites applications for the position of **Director of the Institute for Physical Science and Technology (IPST).** The Institute currently has 35 faculty members, most of whom hold joint appointments in an academic unit such as Physics, Mathematics, Engineering, and Chemistry. The IPST faculty are internationally known and many are heavily involved in scientific computation. They lead major research programs in Applied Mathematics, Chemical and Biological Physics, Optical Physics, Nonlinear Dynamics, Space and Upper Atmosphere Physics, and Statistical Physics. The Director will be an outstanding scientist who will play a leadership role in developing and implementing a vision for the Institute as a major center on the campus that interacts with the teaching departments. Candidates for this position must have an established international reputation in interdisciplinary research with strong management skills. The appointment will be made at the Full Professor level and carries academic tenure. To apply, send a letter of application, curriculum vitae and a list of suggested names and addresses for letters of recommendation to: **Dr. Joseph JaJa, Chair IPST Director Search Committee, Institute for Advanced Computer Studies, University of Maryland, College Park, MD 20742.** To receive full consideration, applications should be received by Nov. 15, 2000. For more information, please contact Dr. Joseph JaJa at 301-405-6722 or joseph@umiacs.umd.edu. The University of Maryland is an affirmative action, equal opportunity employer. Women and minorities are encouraged to apply. Applications will be accepted until the position is filled.

MICHIGAN STATE UNIVERSITY - DEPARTMENT OF MATHEMATICS - Chairperson - Michigan State University invites nominations and applications for the position of Chairperson of the Department of Mathematics. MSU is a land-grant and AAU institution with total enrollment of approximately 43,000 graduate and undergraduate students. The Department of Mathematics is a group I research department and a major participant in the instructional and research activities of the university. Its personnel include 68 tenure stream faculty and more than 125 graduate students in the areas of pure and applied mathematics and mathematics education. The Chair will lead the faculty in shaping and developing the department's research, instructional, and service programs, including recruitments into numerous forthcoming faculty openings. Candidates should possess a Ph.D. in the mathematical sciences, outstanding research credentials, and an established record of university and professional service appropriate for a tenured appointment at the rank of professor. Candidates should also demonstrate effective leadership, communication, and administrative skills. The new Mathematics Chair must be strongly committed to: supporting continued improvement in the department's research standing, promoting growth in the areas of applied mathematics and mathematics education, developing interdisciplinary research initiatives, furthering excellence in teaching and instructional innovation, and enhancing relations within and outside the mathematics community. The position of Chairperson carries tenure at the rank of professor, and is available on 1 September 2001. Salary will be competitive, and commensurate with qualifications. To apply, please send a vita and have at least four letters of recommendation sent to: **Professor Joel Shapiro, Chair Search Committee, Department of Mathematics, Michigan State University, East Lansing, MI 48824.** Applications will be considered until the position is filled. Completed applications (including letters of recommendation) received by December 15, 2000 will be assured of full consideration. Applications are strongly encouraged from members of groups that are traditionally underrepresented in mathematics. MSU is an Affirmative Action/Equal Opportunity Institution.

AWM EVENTS at the 2000 SIAM Annual Meeting

July 9 - 14, 2000, Westin Rio Mar Beach Resort, Rio Grande, Puerto Rico

AWM WORKSHOP: Focus on Research & Career Advice

The Association for Women in Mathematics (AWM) plans a workshop from Sunday evening through mid-day Tuesday, July 9-11, 2000. The sessions focus on showcasing the research of women graduate students and recent Ph.D. mathematicians and helping individuals to prepare for careers in the mathematical sciences. Our first session is a minisymposium, which focuses on career planning and experiences. The workshop also has two research minisymposia presented by recent Ph.D. mathematicians and a poster session presented by graduate students. In addition, starting off our events on Sunday evening will be a dinner and discussion groups.

These events are held in conjunction with the 2000 SIAM Annual Meeting. There is NO registration fee for this AWM workshop. The minisymposia and poster session are **open to all SIAM meeting attendees**. Pre-registration for the AWM dinner is required. The Workshop is funded through grants from the Office of Naval Research (ONR) and the National Science Foundation (NSF).

For a detailed schedule and other SIAM Annual Meeting events see: **<www.siam.org/meetings>**, **<www.awm-math.org>**. A complete two page AWM Workshop schedule was published in the May/June 2000 *AWM Newsletter* (Volume 30, Number 3, pp. 32-33).

AWM EVENTS at the MATHFEST 2000

August 3 - 5, 2000, University of California, Los Angeles, California

Thursday, August 3, 2000, 8:00 p.m. Grand Horizon Ballroom Terrace, Sunset Village, UCLA

AWM Reception

following the Mathfest Barbeque. All meeting attendees are invited.

Friday, August 4, 2000, 8:30 a.m.-9:20 a.m. Grand Horizon Ballroom, Sunset Village, UCLA

AWM-MAA Invited Address

"Finite Quantum Chaos" presented by Audrey Terras, University of California, San Diego

For further details on the **Mathfest 2000** meeting see: **<www.maa.org/meetings>**.

AWM EVENTS at the Mathematical Challenges of the 21st Century

August 7 - 12, 2000, University of California, Los Angeles, California

Mathematical Challenges of the 21st Century promises to be a meeting of historical significance. A stellar lineup of thirty-one speakers, including eight Fields Medallists and other eminent prize winners, will represent the depth and range of modern mathematics and bring to life its current and future impact on the sciences and practical affairs of the world-from commerce, to communications, to medicine. Be a part of this special World Mathematical Year 2000 event: come to meet, to learn, to exchange ideas, and to celebrate with the speakers and your colleagues.

Monday, August 7, 2000, 8:00 p.m. - 9:00 p.m. Grand Horizon Ballroom, Sunset Village, UCLA

AWM Special Presentation: a talk and discussion

"Demographic trends and challenges for mathematics" presented by Carolyn R. Mahoney, California State University, San Marcos

Monday, August 7, 2000, 9:00 p.m. Grand Horizon Ballroom Terrace Sunset Village, UCLA

AWM Reception

following the AWM Special Presentation. All meeting attendees are invited.

AWM is also pleased to announce that AWM President Jean Taylor and Professor Karen Uhlenbeck will be presenting two of the invited addresses at this meeting.
All invited talks will be held in the Auditorium in Royce Hall, UCLA.

Monday, August 7, 2000, 4:30 p.m. - 5:30 p.m. Auditorium, Royce Hall, UCLA

Invited Address

"Geometric Partial Differential Equations: From Hilbert's 23rd Problem to nonlinear waves"
presented by Karen Uhlenbeck, University of Texas at Austin

Wednesday, August 9, 2000, 3:15 p.m. - 4:15 p.m. Auditorium, Royce Hall, UCLA

Invited Address

"Mathematics and Materials Science"
presented by AWM President Jean E. Taylor, Rutgers University

For further details on the **Mathematical Challenges of the 21st Century** meeting see:
<www.ams.org /amsmtgs/mathchall.html>

IMA Career Workshop:
Connecting Women in Mathematical Sciences to Industry

Friday, September 8, 2000 - Sunday, September 10, 2000

to be held at the

Institute for Mathematics and its Applications (IMA)
University of Minnesota, Minneapolis, Minnesota

co-sponsored by the Association for Women in Mathematics (AWM)

Organizers: Suzanne M. Lenhart, University of Tennessee, Knoxville, lenhart@math.utk.edu
Margaret H. Wright, Bell Laboratories, Lucent, mhw@research.bell-labs.com
Rosemary E. Chang, rechang@earthlink.net

Mathematical problems arising in industrial applications typically involve complicated, interdisciplinary issues of formulation, analysis and solution. Many women in mathematical sciences today are contributing to this important work in industrial applications, but more women should be informed of the opportunities provided by real world problems for high quality research, contributions to practical solutions and rewarding careers. This weekend workshop is intended to increase and enhance the awareness of women mathematicians about industrial applications.

The diverse nature of industrial applications will be conveyed through technical talks by selected participants, chosen based on their successful experiences with real world problems. A panel of women established in successful industrial careers will give their viewpoints to encourage women to become involved with industrial problems. Focused small group discussions will be included to exchange ideas on strategies to enhance the participation of women in industrial applications.

Provided sufficient funding is confirmed, this workshop will include approximately 60 invited participants: 20 mathematical scientists and managers whose work involves solving industrial problems, and 40 graduate students in applied mathematics and related fields.

List of Confirmed Senior Participants as of 6/15/2000

Rosemary E. Chang
Alessandra O.P. Chiareli, Cororate Research Labs, 3M
Carolyn R.S. Cho, Bioinformatics Mathematical Biology, SmithKline Beecham R&D
Sharon K. Filipowski, Boeing Company
Anna Gilbert, AT&T Labs-Research
Sonja Glavaski, Control and Dynamics, MN65 2810, Honeywell Technology Center
Kathleen A. Hoffman, Mathematics, University of Maryland, Baltimore County
Sarah E. Holte, HIVNET Statistical Center, Fred Hutchinson Cancer Research Center
Tamara G. Kolda, Sandia National Laboratories
Suzanne M. Lenhart, Mathematics, University of Tennessee
Lynne Parker, Oak Ridge National Laboratory
Margaret H. Wright, AT&T Bell Laboratories
Bin Yu, Statistics Research, Bell Laboratories and UC Berkeley

For further details and possible funding to participate in this meeting see:
<www.ima.umn.edu/women_in_industry.html>

ASSOCIATION FOR WOMEN IN MATHEMATICS

1999/2000 MEMBERSHIP FORM

LAST NAME, FIRST NAME M.I.

ADDRESS

AWM's membership year is from October 1st to September 30th. Please fill-in this information and return it along with your DUES to:

AWM Membership
4114 Computer & Space Sciences Building
University of Maryland
College Park, MD 20742-2461

The AWM Newsletter is published six times a year and is part of your membership. Any questions, please contact AWM at awm@math.umd.edu or (301) 405-7892.

Email:
Home Phone:
❑ **do not** publish home number

Work Phone:
❑ **do not** publish work number

❑ ⇦ I DO NOT wish for my AWM membership information to be released for the **Combined Membership List.**

PROFESSIONAL INFORMATION:
Position:
Institution/Company:
City, State, Zip:

If student, GRADUATE or UNDERGRADUATE? (circle one)
If not employed, leave position & institution blank

DEGREES EARNED:

	Degree(s)	Institution(s)	Year(s)
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Master's:			
Bachelor's:			

INDIVIDUAL DUES SCHEDULE

Please check the appropriate membership category below. Make checks or money order payable to: **Association for Women in Mathematics**.
NOTE: All checks must be drawn on U.S. Banks and be in U.S. Funds. AWM Membership year is **October 1st to September 30th.**

REGULAR INDIVIDUAL MEMBERSHIP..... $ 50 _____

2ND FAMILY MEMBERSHIP..... $ 30 _____
(NO newsletter) Please indicate regular family member: _____

CONTRIBUTING MEMBERSHIP..... $100 _____

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ALL FOREIGN MEMBERSHIPS (INCLUDING CANADA & MEXICO).....**FOR ADDITIONAL POSTAGE ADD** $ 8 _____
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BENEFACTOR [$2,500] or FRIEND [$1,000] (circle one)..... $ _____

❑ I am enclosing a DONATION to the **"AWM GENERAL FUND"**..... $ _____

❑ I am also enclosing a DONATION to the **"AWM ANNIVERSARY ENDOWMENT FUND"**..... $ _____

Indicate if you wish for your **contribution(s)/donation(s)** to remain ANONYMOUS ⇨ ❑
Dues in excess of $15 and all cash contributions/donations are deductible from federal taxable income.

INSTITUTIONAL DUES SCHEDULE

J/A00

	U.S.	FOREIGN	
_____Sponsoring CATEGORY I (may nominate 10 students for membership).....	$150	$230	_____
_____Sponsoring CATEGORY II (may nominate 3 students for membership).....	$ 95	$120	_____

INSTITUTIONAL MEMBERS WILL RECEIVE ONE FREE JOB ADVERTISEMENTS **(up to four lines)** IN OUR NEWSLETTER PER YEAR. Advertising deadlines are the 1st of every EVEN month. All institutions advertising in the AWM Newsletter are Affirmative Action/Equal Opportunity Employers. Also, Institutions have the option to nominate students to receive the newsletter as part of their membership. NOTE: List names and addresses of student nominees on opposite side or attach separate page. [ADD $15 ($23 for foreign members) for each additional student add-on over initial 10 students for Category I; over initial 3 students for Category II]

❑ indicate if **GIFT membership FROM:** _____ **TOTAL ENCLOSED** $ _____

AWM

Volume 30, Number 4, July–August 2000

ADDRESS CORRECTION FORM

❒ Please change my address to:

❒ Please send membership information to my colleague listed below:

❒ No forwarding address known for the individual listed below (enclosed copy of label):

(Please Print)

Name_____

Address_____

_____

City_____ State_____ Zip_____-_____

Country (if applicable)_____ E-mail Address_____

Position_____ Institution/Org._____

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4114 Computer & Space Sciences Bldg., University of Maryland, College Park
Maryland 20742-2461

or E-MAIL:

awm@math.umd.edu

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